Claims

1. A method for detecting the magnetic flux, the rotor position and/or the rotational speed of the rotor in a single- or multi-phase permanent magnet motor or -synchronous motor or -generator using the stator voltage equations:

$$\text{Equation} \quad (1) \qquad L \cdot \dot{i}_\alpha = -R \cdot i_\alpha + p \cdot \omega \cdot \psi_{m\beta} + u_\alpha$$

$$\text{Equation} \quad (2) \qquad L \cdot \dot{i}_\beta = -R \cdot i_\beta - p \cdot \omega \cdot \psi_{m\alpha} + u_\beta$$

in which	L	is the inductance
	i_α	the current in the direction α
	i_β	the currect in the direction β
	$\dot{i}_\alpha$	the derivative with respect to time of the current in the direction α
	$\dot{i}_\beta$	the derivative with respect to time of the current in direction β
	R	the ohmic resistance
	p	the pole pair number
	ω	the rotational speed of the rotor
	$\psi_{m\alpha}$	the magnetic flux in the direction α
	$\psi_{m\beta}$	the magnetic fluix in the direction β
	u_α	the voltage in direction α
	u_β	the voltage in the direction β.

wherein with the evaluations, the energy conditions of the rotor (2) are also taken into account.

2. A method according to claim 1, wherein the energy conditions in the magnet (5) of the rotor (2) are taken into account by way of the following energy equations of the rotor:

$$\text{Equation (3)} \qquad \dot{\psi}_{m\alpha} = -p \cdot \omega \cdot \psi_{m\beta}$$

$$\text{Equation (4)} \qquad \dot{\psi}_{m\beta} = p \cdot \omega \cdot \psi_{m\alpha}$$

wherein

$\dot{\psi}_{m\alpha}$ is the derivative with respect to time of $\psi_{m\alpha}$ and

$\dot{\psi}_{m\beta}$ the derivative with respect to time of $\psi_{m\beta}$.

3. A method according to one of the preceding claims, wherein the motor model defined by the equations (1) to (4) is corrected in dependence on a comparison between computed model values (^) and measured electrical and/or mechanical values by way of at least one correction term (9), so that there results the following equations:

$$\text{Equation (1a)} \qquad L \cdot \dot{i}_\alpha = -R \cdot i_\alpha + p \cdot \omega \cdot \psi_{m\beta} + u_\alpha + \upsilon_{1\alpha}$$

$$\text{Equation (2a)} \qquad L \cdot \dot{i}_\beta = -R \cdot i_\beta - p \cdot \omega \cdot \psi_{m\alpha} + u_\beta + \upsilon_{1\beta}$$

$$\text{Equation (3a)} \qquad \dot{\psi}_{m\alpha} = -p \cdot \omega \cdot \psi_{m\beta} + \upsilon_{2\alpha}$$

$$\text{Equation (4a)} \qquad \dot{\psi}_{m\beta} = p \cdot \omega \cdot \psi_{m\alpha} + \upsilon_{1\beta}$$

in which $\upsilon_{1\alpha}, \upsilon_{1\beta}, \upsilon_{2\alpha}, \upsilon_{1\beta}$ are correction terms

4. A method according to claim 3, wherein the measured electrical values are the motor currents.

5. A method according to one of the preceding claims, wherein the correction terms (9) are in each case formed from a correction factor and the difference between measured and computed motor currents.

6. A method according to one of the preceding claims, wherein the correction terms (9) in the equations (3a) and (4a) in the one phase are formed by way of the difference between measured and computed currents of the other phase, wherein the correction term is introduced into equation (3a) with a negative polarity.

7. A method according to one of the preceding claims, wherein the rotational speed is detected sensorically.

8,. A method according to claims 7, wherein the rotational speed is determined with the help of a Hall sensor.

9. A method according to one of the preceding claims, wherein the rotational speed is evaluated by calculation in a manner such that the difference between the flux speed and an assumed rotor speed or variables derived therefrom is formed as a rotational speed correction term (11) and the actual [current] rotational speed is evaluated by way of an approximation process.

10. A method according to claim 9, wherein the rotational speed correction term (11) is corrected by way of a rotational speed measurement.

11. A method according to one of the preceding claims, wherein the assumed rotor rotational speed by way of a rotational speed correction term (11) is adapted in an adapter block (10) to the actual [current] rotational speed.

12. A method according to one of the preceding claims, wherein the assumed rotational speed by way of a rotational speed correction term

(11) is adapted in a rotational speed model to the actual rotational speed.

13. A method according to one of the preceding claims, wherein for evaluating the flux speed one determines the position of the magnetic flux and specifically by way of the equation

$$\text{Equation} \quad (5) \qquad \rho = \frac{1}{p} \cdot Arctg \left(\frac{\psi m\beta}{\psi m\alpha} \right)$$

14. A method according to claim 13, wherein the equation (5) is differentiated with respect to time and the equations (3a) and (4a) (for calculated evaluation of the rotational speed) are substituted into the differentiated equation (5).

15. A method according to claim 12, wherein in the rotational speed model the derivative with respect to time, preferably of the first order, of the rotational speed is used.

16. A method according to one of the preceding claims, wherein the rotational peed model is formed by a mechanical condition equation preferably of the form:

$$\text{Equation (8)} \qquad \dot{\omega} = \frac{1}{J} \cdot (M - M_L),$$

in which	M	is the driving moment,
	M_L	the load moment, and
	J	the moment of inertia of the rotating load.

17. A method according to claim 16, wherein the load moment is set to zero.

18. A method according to claim 17, wherein the drive moment is set to zero.

19. A method according to one of the preceding claims, wherein the load moment is formed by

Equation (11) $M_L = K_1 \cdot \omega^2$,
in which K_1 *is a constant.*

20. A method according to one of the preceding claims, wherein the drive moment is defined by

Equation (10) $M = K_2 \cdot (\psi_{m\alpha} \cdot i_\beta - \psi_{m\beta} \cdot i_\alpha)$,
in which K_2 is a constant.